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VALUE THEORIES APPLIED TO THE SUGAR INDUSTRY

SUMMARY

Recent reports on the sugar industry. The industry both agricultural and manufacturing; may be used to test the theories of marginal cost, representative firm, large and small scale production, 101. — Analysis by cost curves showing cane (or beet) costs, factory costs, and total costs, 105. — Analysis by coefficients of dispersion, 108. — Analysis by Pearson's formula for correlation, 111. — Analysis by frequency histograms and probability curves, 116. — Conclusions, 120.

The publication of government reports giving facts and statistics in regard to industries in the United States affords good opportunities for testing the teachings of economic theory. During the present year two such reports have appeared relating to sugar — one on the beet sugar industry, prepared by the Federal Trade Commission, and the other on the cane sugar industry, prepared by the Department of Commerce.[1] The work on these reports has been thorough and painstaking and the data collected are believed to be accurate. The reports give details in regard to the agricultural and manufacturing processes, some insight into the conditions of labor, and a careful analysis of costs. There are also numerous statistical tables relating to almost every phase of the subject.

It is the publication of such statistical tables which affords the economist his opportunity. The sugar industry is partly extractive and partly manufacturing. According to theory, therefore, it should illustrate, on the one hand, the phenomena of varying cost and producers' surplus, and, on the other hand, uniform cost and the "representative firm." Both phases of the industry are carried on by firms differing greatly in size and, therefore, should show differences in the economies of large and small scale production as applied to agricultural and manufacturing operations. It is the purpose of this paper to find out by the use of modern statistical methods to what extent these predictions of economic theory are verified.

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[1] Report on the Beet Sugar Industry in the United States: Federal Trade Commission, 1917. The Cane Sugar Industry: Department of Commerce, 1917. Both reports, tho published in 1917, describe conditions as they were in 1914. The fact that they refer to this earlier period makes them the more valuable for testing economic theory, since the situation was then not abnormal, as it has been since the outbreak of the European War.

It would be well first to have before us, stated in definite form, just what, on the basis of theory as ordinarily understood, we should expect our statistical treatment to show. We will then be able to see clearly to what extent our expectations are verified or fail to be verified, and, finally, we will attempt to make the necessary limitations and qualifications of theory to account for such discrepancies.

A little more than half of the world's supply of sugar is obtained from the sugar cane and a little less than half from the sugar beet. The sugar cane calls for a tropical climate, as the maximum sugar content is not obtained until it has been growing for over a year. It also calls for abundant rainfall and certain characteristics of soil. These conditions are realized more or less perfectly at various points within a belt extending about the earth between the thirtieth degrees north and south of the equator. The sugar beet, on the other hand, requires a temperate climate, much sunlight but not too intense, considerable moisture when the beets are young, very little or none when they are maturing and storing up sugar. While, therefore, the areas upon which sugar may be produced are widely distributed, the peculiar conditions most favorable for its production are somewhat limited; and, the demand being strong and steadily increasing, it becomes necessary to resort to soils and climates less and less favorable to its production.

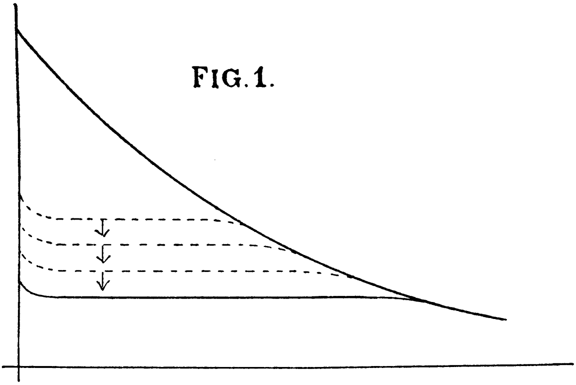
Under such conditions we should expect the sugar industry on its agricultural side to exhibit the phenomena of commodities produced at varying cost. We should expect the supply curve for both cane and beet to be of the ascending type, with the price — allowing for freight differences and tariffs — near the cost to the marginal producer, thus yielding to more favorably located producers economic rent. A frequency graph constructed from the same data should show considerable dispersion. Still, one can easily imagine conditions when there would be a high degree of concentration. For example, a country in which there was only a small amount of " best " land and marginal land used in the industry, while the great mass of the product came from moderately good land of uniform productivity. Again, a frequency graph might under some conditions be closely fitted by a normal probability curve, or there might be a decided " skew " to the right or the left. On the whole, however, we should expect a greater degree of concentration in costs in a manufacturing than an extractive industry.

When we come to the manufacture of sugar from the cane or the beet we are dealing with a highly capitalized machine process. On the basis of theory, therefore, we should expect the line of costs to be of the horizontal type. And as the industry is in the hands of numerous competing producers the concept of the representative firm would be expected to apply. This would be indicated by a dip in the line of costs at one end to represent the cost of production to the " supermen " who reap a certain amount of "rent of ability," and an elevation at the other end to represent the costs to the new, struggling, or moribund firms. But the line throughout the greater part of its extent should be approximately horizontal, the ordinates measuring the cost to the "representative firms," which cost determines the price.

It may be objected that since the factory processes are of the machine type, the cost of production should decrease with an increase in the output, and that therefore the curve should descend to the right, the typical form for production under conditions of "decreasing cost." But it must be remembered that the descending type of curve introduces a time element. It may be defined as the locus of the right hand extremity of a bodily-descending, rightward-lengthening, horizontal line. Or rather, introducing the concept of the representative firm and admitting some degree of difference in the costs of production, the bodily-descending line would not be straight but, as explained above, would be in the form of a reversed curve, the greater part of whose extent was an approximately horizontal line. At any given instant of time the line plotted from data of costs should be such a reversed curve. Whether the high or low end of the curve appears at the right is simply a matter of arrangement of data. If we draw an analogy from the case of increasing cost, where the marginal cost, represented by the ordinate at the extreme right, determines the price, it might appear more logical in the case of decreasing cost, to place the low end of our reversed curve to the right. For altho it is the cost to the representative firm which determines the price today, it is the cost to the "captain of industry" of today which is likely to determine the price tomorrow. The concept of this paragraph may be graphically symbolized as shown by figure on page 105.

If a frequency graph were constructed from the factory costs it should show great concentration about the cost to the representative firm. We should rather expect a fairly close approximation to the bell-shaped normal probability curve. However, there might be a "skew" to the right or left as there chanced to be at the instant of taking the data a considerable portion of the product derived from firms inferior or superior in their efficiency to the representative firm.

FIG. 1.



Finally, since it has generally been held on grounds of theory that agriculture is a field favorable to small-scale production, while manufacturing is favorable to large-scale production, we should expect in the cane and beet industry the low-cost firms to be the smaller firms, while in the factory processes we should expect the low-cost firms to be the larger firms.

Such are the conclusions of theory. When we come to a statistical study of the data we find the results so similar from all four[1] sources of supply — even in the case of beet sugar as distinguished from cane sugar — that any one of them may be selected for purposes of discussion. We will select for chief emphasis Hawaii, because of the detailed and scientific methods of accounting by the Hawaiian producers, and submit, with but little comment, diagrams illustrative of conditions in the other sources of supply.

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[1] Other important sources of the sugar supply for the United States are Louisiana, Texas, and the Philippines. No data were obtainable from the Philippines, and the data from Louisiana and Texas were lacking in details essential to the purposes of this study.

First, then, let us take the forty-five factories in Hawaii and from the data construct cost curves arranged in the order of ascending total costs (Figure 2). The ordinates to the heavy upper line, AB, measure the total costs; the ordinates to the full middle line, CD, measure the cane costs; and the ordinates to the dotted lower line, EF, measure the factory costs for each of these producers.

Several interesting conclusions at once suggest themselves from a mere inspection of the diagram. (1) The cane cost is a much more important element of the total cost than is the factory cost. (2) Both the cane costs and the factory costs differ widely among themselves. (3) The ascending line of total costs suggests the conditions predicted for an industry subject to the law of varying or increasing cost, and the line of cane costs approximately parallels the line of total costs. (4) The line of factory costs, however, shows little tendency to parallel the line of total costs. It zigzags across the figure above and below a nearly horizontal line. (5) On the whole, the low-cost factories with respect both to cane and factory costs appear to be the large factories.

The diagram (Fig. 2) represents the factories arranged according to total costs. We may segregate cane costs and factory costs and arrange each of these in order of magnitude and plot corresponding diagrams. Such a treatment appears in Figure 3. In Figure 2, any verti-

FIG. 2.

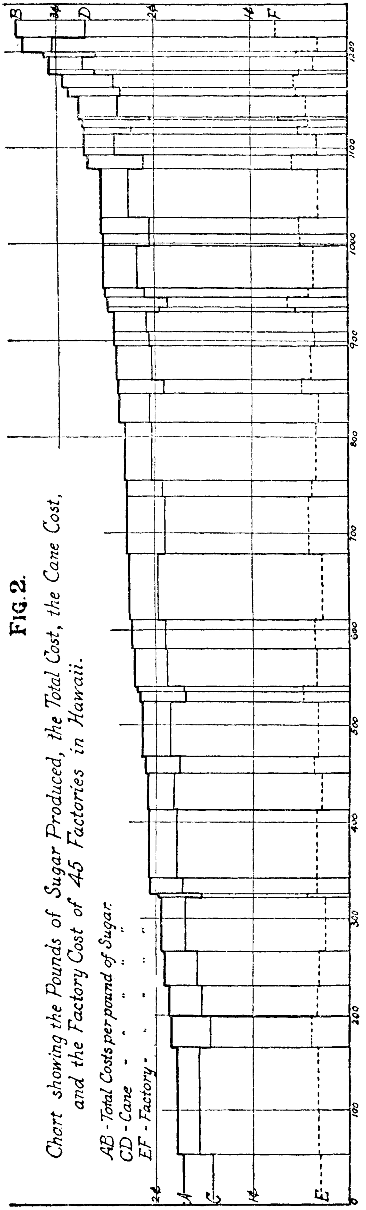

Chart showing the Pounds of Sugar Produced, the Total Cost, the Cane Cost, and the Factory Cost of 45 Factories in Hawaii.

FIG. 3.

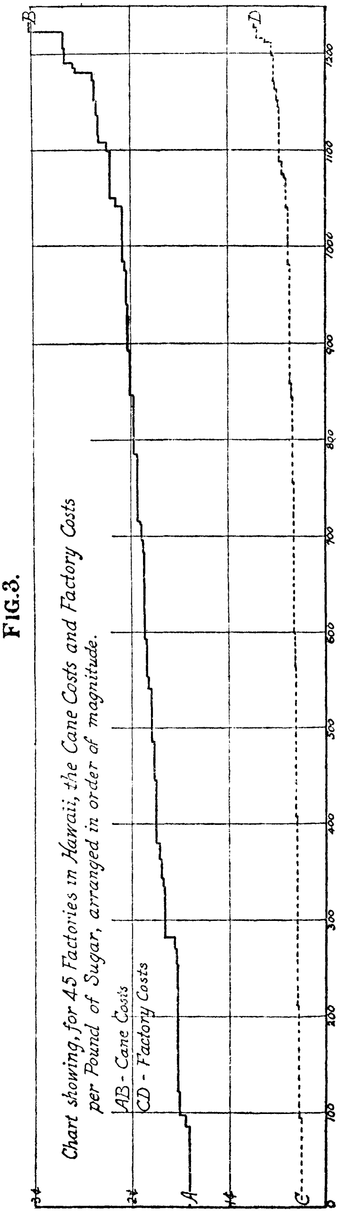

Chart showing, for 45 Factories in Hawaii, the Cane Costs and Factory Costs per Pound of Sugar, arranged in order of magnitude.

cal section will intersect the factory, cane, and total costs of the same factory: in Figure 3, factory and cane costs intersected by such a section will not in general be for the same factory.

The most striking feature of this diagram is the similarity of the two curves. They are both of the ascending, varying cost type. Such a curve was to be expected for the cane costs, but not for the factory costs. For them we anticipated a horizontal line or at most a line approximately horizontal — slightly depressed at one end and elevated at the other. Of course, as explained above, if we had plotted our data for factory costs, beginning with the greatest instead of the least, the curve would have appeared to be descending, and perhaps logically this would have been the better way to plot it.[1] But such a construction would not alter the wide dispersion of costs. The ratio of the highest factory cost to the lowest is 3.04 (.73 : .24), while the ratio of the highest cane cost to the lowest is only 2.15 (3.03 : 1.41). Granting that extremes may be exceptional and afford an unsatisfactory measure of dispersion, the case is not much improved when we compute, and use as our measure, coefficients of dispersion: .135 for cane costs and .232 for factory costs, when computed on the basis of average deviations, and .177 for cane costs and .300 for factory costs, when computed from standard deviations.

That the case is not exceptional for Hawaii is shown by the fact that the results are similar for the other sources of supply, as is shown by the following table:

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[1] Even in the case of production under conditions of varying cost, a curve plotted from data taken at any given instant of time would be steeper than the theory of economic rent would account for. There would be efficient and inefficient producers in such an industry also. The lowest cost would be that of the "captain of industry" operating on the best site, who would reap both economic rent and rent of ability. The highest cost would be that of a new, inefficient, or decaying concern operating at a loss on marginal land.

Measures of Dispersion in Cane (or Beet) Costs and Factory Costs in the Sugar Industry

Location or character of industry	Ratio of highest cost to lowest		Coefficients of dispersion	
	Cane (or beet) cost	Factory cost	Cane (or beet) cost	Factory cost
Hawaii....	2.15 (3.03 : 1.41)	3.04 (.73 : .24)	.135	.232
Cuba.....	2.12 (1.65 : .78)	3.28 (.72 : .22)	.132	.204
Porto Rico	1.83 (2.81 : 1.53)	2.81 (.71 : .25)	.097	.210
Beet Sugar	2.73 (4.48 : 1.64)	11.20 (4.92 : .44)	.184	.326

In the above table, in computing the coefficients of dispersion, the average deviation was used. Results very similar in the inferences to be derived from them would have been obtained had the standard deviation been used.

It may help to visualize the matter to have all of the curves of costs before us. They may be studied, drawn to the same scale, in Figure 4.

How are we to account for this unexpected result ?[1] Several possible solutions suggest themselves. In the first place the raw material is the chief element of cost in the production of sugar. When the cane or beet is at the factory the sugar producer has already incurred the greater part of his expense. This is true even in the case of the beet sugar industry, tho to a less degree than in the case of cane.[2] The relative magnitude of cane

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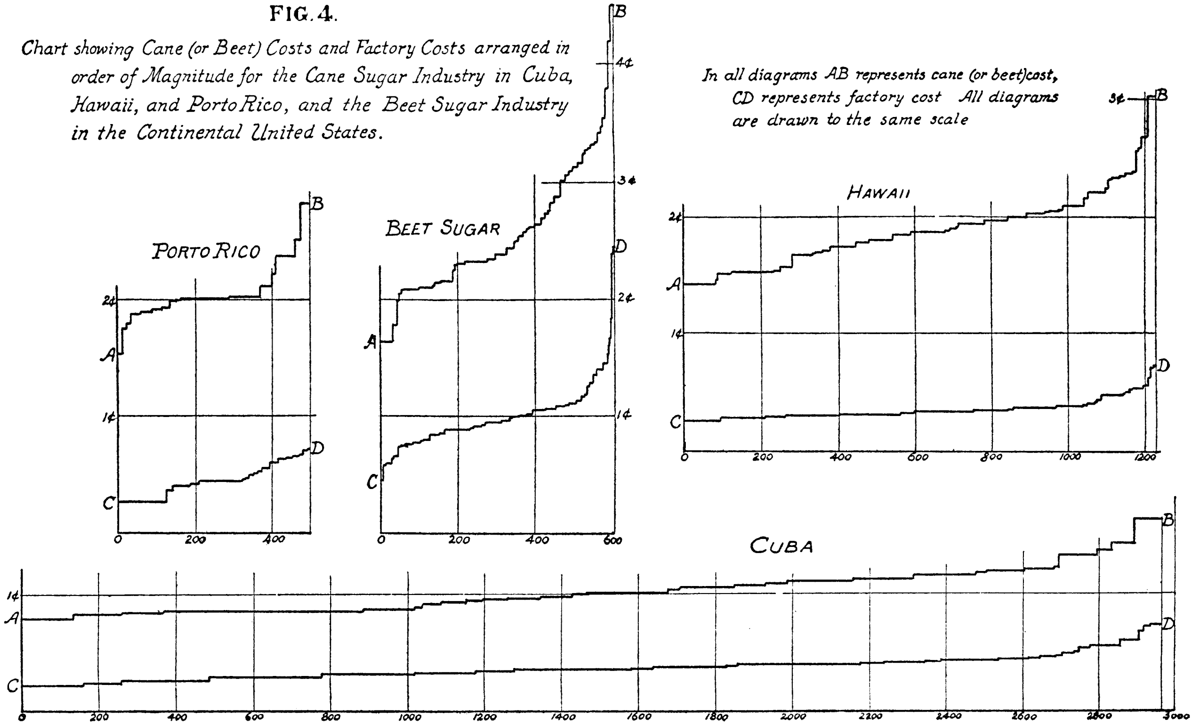
[1] A careful inspection of the diagrams does show, however, a slightly greater horizontal tendency for the line of factory costs than for the line of agricultural costs, in each case, throughout the central portion of its course. This slightly greater concentration is shown in the comparative histograms, Figure 5. It would also have shown in the coefficients of dispersion, had we taken the pound of sugar instead of the factory as the unit. To this extent the conclusions of theory are verified.

[2] The cane and beet sugar industries are not altogether comparable. The " finished product " turned out by the cane sugar factories is " raw " sugar, and must undergo another distinct process, performed by the great sugar refineries of the so-called sugar trust, before it is comparable with the " refined sugar " which is the finished product of the beet sugar factories. In the beet sugar factories, therefore, the factory cost, including both processes, is a more important element of the total cost than it is in the cane sugar industry.

FIG. 4.

Chart showing Cane (or Beet) Costs and Factory Costs arranged in order of Magnitude for the Cane Sugar Industry in Cuba, Hawaii, and Porto Rico, and the Beet Sugar Industry in the Continental United States.



In all diagrams AB represents cane (or beet) cost, CD represents factory cost All diagrams are drawn to the same scale (or beet) costs and factory costs is indicated to the eye in the diagrams, and is shown numerically in the following table:

Location or character of industry	Average cane or beet cost Cents per pound	Average factory cost Cents per pound
Hawaii	.0201	.0040
Cuba	.0103	.0041
Porto Rico	.0202	.0050
Beet Sugar	.0281	.0113

It will be seen that the factory cost varies from about $\frac{3}{10}$ of the total cost in the case of the beet sugar industry to only $\frac{1}{6}$ in the case of the cane sugar industry in Hawaii. While therefore the dispersion of factory costs as compared with their own mean is greater than the dispersion of cane (or beet) costs the absolute effect of such dispersion upon the total cost is less. For example, in Hawaii the ratio of .73 cent to .24 cent (factory costs) is much greater than the ratio of 3.03 cents to 1.41 cents (cane costs); yet the former adds only .49 cent to the cost per pound of sugar while the latter adds 1.62 cents, and it is the absolute difference which counts in the competition between sellers of sugar. A sugar producer, therefore, can stand a relatively high cost in his factory if he is favorably situated with respect to his supply of cane or beet. The problem of paramount importance to him is to reduce his cost of raw material.

The close relation between the cane cost and the total cost is very evident to the eye from Figure 2 as already noted. This close relationship may be shown even more impressively by applying Pearson's formula for correlation. The following table will exhibit the coefficients of correlation between cane (or beet) costs and total costs, factory costs and total costs, and cane (or beet) costs and factory costs:

CORRELATIONS OF COSTS IN THE SUGAR INDUSTRY COMPUTED BY PEARSON'S FORMULA

Location or character of industry	Coefficients of correlation		
	Cane (or beet) — Total	Factory — Total	Cane (or beet) — Factory
Hawaii...........	.935	.585	.257
Cuba.............	.815	.451	−.100
Porto Rico........	.898	.234	−.231
Beet Sugar........	.760	.643	.096

The very high, almost perfect, correlation between the cost of raw material and the total cost is at once apparent from the table. There is a moderate correlation also between the factory cost and the total, greatest in the case of beet where, as explained above [footnote p. 109] the factory cost is a more important element than is the case with cane. The correlation between the cane (or beet) cost and the factory cost is negligible.[1] When positive, it perhaps indicates that a concern which is efficient in operating its factory is likely also to be efficient in securing its cane or beet supply. This correlation, however, is very low, and, indeed, in Cuba and Porto Rico it is negative.

But the relative unimportance of the factory operations as compared with the agricultural operations as elements of the total cost could not, taken by itself, account for the dispersion of factory costs. If the two phases of the industry were entirely independent, if the cane or beet sold in the markets of the world at a uniform price, determined, let us suppose, by the cost of production to a representative firm at the margin of cultivation, then the force of competition, acting upon the factories, would be much more potent in eliminating the inefficient firms and would thus tend to bring about a much closer approximation to a uniform cost of production among them. But the two phases of the industry are not independent. In the Report on the Beet Sugar Industry, we read (page 152):

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[1] The probable errors in this set of correlations are, Hawaii, .093; Cuba, .093; Porto Rico, .146; Beet, .076.

> Perhaps no other manufacturing industry is so sensibly dependent upon agriculture as the beet sugar industry. On the other hand, no other branch of farming of equal importance is so entirely dependent upon a strictly local industry. Other industries are dependent upon the farmer for their principal raw material, but their relations with the farmer are so distant as not to be a sensitive factor. The cotton manufacturer and the miller must depend upon the cotton and grain grower for their supplies of raw material, but millions of farmers in various parts of the world grow these commodities. These farm products are of such a character and their manufacture is of such a nature that they can be economically shipped thousand of miles. Thus the farmer and the manufacturer may be widely separated.
>
> Sugar beets, however, cannot be economically shipped a long distance. Only about 12½ per cent of the weight of beets is extractable sugar, the extreme range being about 10 per cent to about 16 per cent, and the average is about 12½ per cent. Thus, if the freight charges on a ton of beets are 40 cents, or 2 cents per 100 pounds, the charge on the extractable sugar will average about 16 cents per 100 pounds. It is apparent, therefore, that the sugar factory and the beet grower must be near each other; otherwise, the farmer must sell his beets at a lower price than he can afford. The sugar manufacturer must obtain his beets at a price that will enable him to sell his product in competition with cane sugar or he will fail.

The above was written with reference to the beet sugar industry, but, with the change of a few words, it would apply almost equally well to the cane. Under such conditions of production it is apparent that competition could have little tendency to reduce factory costs to a uniform level. An inefficient factory, provided it were favorably located with respect to cane or beet supply, might continue to compete indefinitely. For its rival, however efficient, could not, because of the necessarily local character of the cane or beet supply, so extend its operations as to satisfy the demand, and therefore it would not undersell and drive its inefficient competitor out of the race. It would prefer to sell at the marginal price and reap its "rent of ability." This would be the result even when, as in the beet sugar industry, the beets are grown by nominally independent[1] farmers and sold to the factory. The case is even stronger, when, as in Hawaii, the factory actually owns and operates its own plantations. Under such conditions it is obviously only the total cost that counts in determining whether a competitor can survive. A high factory cost may be offset by a low cane cost and *vice versa.*

But even this is not the whole story. The refining of sugar is an independent industry. Its raw material, "raw" sugar, is obtained at a uniform price (allowing for freight differences) in a world market. Detailed figures are not available, but such as we have indicate that here also there is a wide dispersion of costs, varying from .36 to .59 cents per pound of refined sugar produced. In the absence of more complete data we can only speculate as to the explanation of the persistence of such a dispersion. Does a partial monopoly have anything to do with it ? Should a series of years, rather than a single year, be taken as a basis of investigation ? Costs may in the long run be uniform for competing firms tho differing widely for a single year, "bad" years being offset by "good" years. When the demand for a product is strong and increasing, do the forces of competition even in independent, manufacturing industries tend to bring about so nearly a uniform cost as theory has supposed ? New factories and a new labor force cannot be assembled in a day, especially when the initial outlay for fixed capital is large. Is there not always under such conditions a large volume of quasi rent?

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[1] "Nominally independent," because the farmers produce under a form of contract which makes them virtually little more than factory employees. Much the same relation exists between the factories and the "colonos" in Cuba. In Cuba, however, as in Hawaii, much of the cane is grown directly under the factory management.

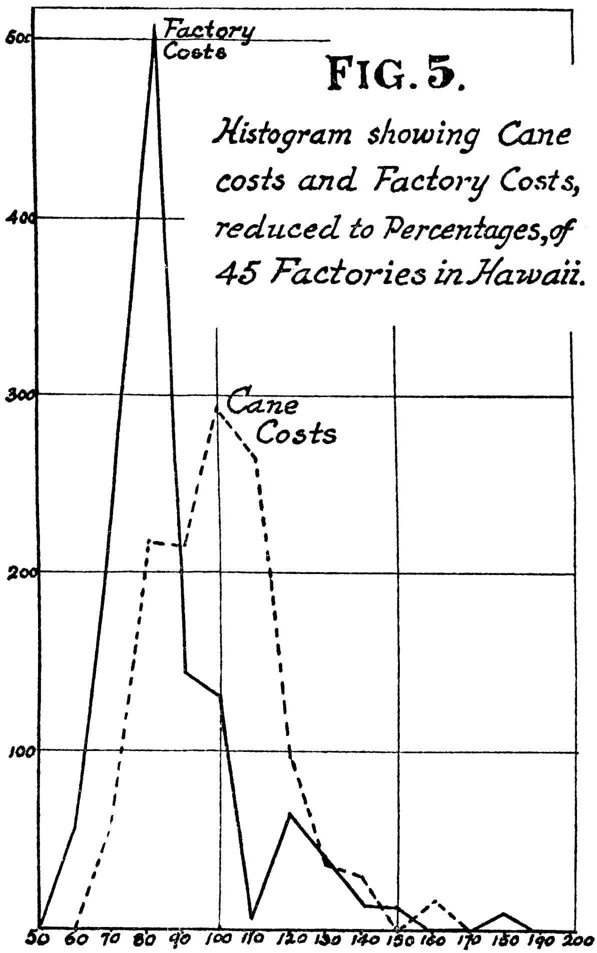

FIG. 5.

Histogram showing Cane costs and Factory Costs, reduced to Percentages, of 45 Factories in Hawaii.

The whole matter suggests the desirability of gathering data from many industries to test this item of economic theory: a desirability which the increasing scrutiny of governments into the conduct of private business enterprises is likely to make more and more a possibility.

We have studied the degree of concentration of costs by means of cost curves and coefficients of dispersion. Another interesting method is by means of frequency graphs. This method has the merit of making the concentration visible to the eye. It also throws light on the extent to which economic rent is enjoyed. The histograms shown in Figure 5 compare the factory and cane costs for the forty-five factories from which data were secured in Hawaii. In order to make a fair comparison the data of costs were in this case reduced to percentages before plotting so that the two histograms might be on the same scale. It will be noticed that both factory and cane costs show a marked degree of concentration about a cost not far from the lowest, with a tendency to " tail off " to small increments of product, considerably dispersed, in the direction of higher costs.

In one respect this treatment is more instructive than that followed in computing coefficients of dispersion, as it takes the pound of sugar produced, rather than the factory, as the unit. The two treatments, taken together, show that while there is considerable dispersion in costs, as between factories, the great mass of sugar produced in Hawaii is produced at an approximately uniform cost, the dispersion with respect to factories and the concentration with respect to quantity of sugar applying to both factory and plantation costs, but more markedly with respect to factory costs.

Figure 6 shows the distribution of total costs for Hawaii, Cuba, Porto Rico, and the beet sugar industry. In each case the histogram has been fitted with a normal probability curve. The shape and close fit (except in the case of beet) show that the distribution of costs, at each source of supply, follows approximately the law of mathematical chance, suggesting that the greater part of the product is derived from land of approximately uniform excellence, the quantity obtained from land better than this being about offset by the quantity obtained from land inferior, and that business skill, a mental characteristic, follows much the same mathematical law as height and weight, physical characteristics.

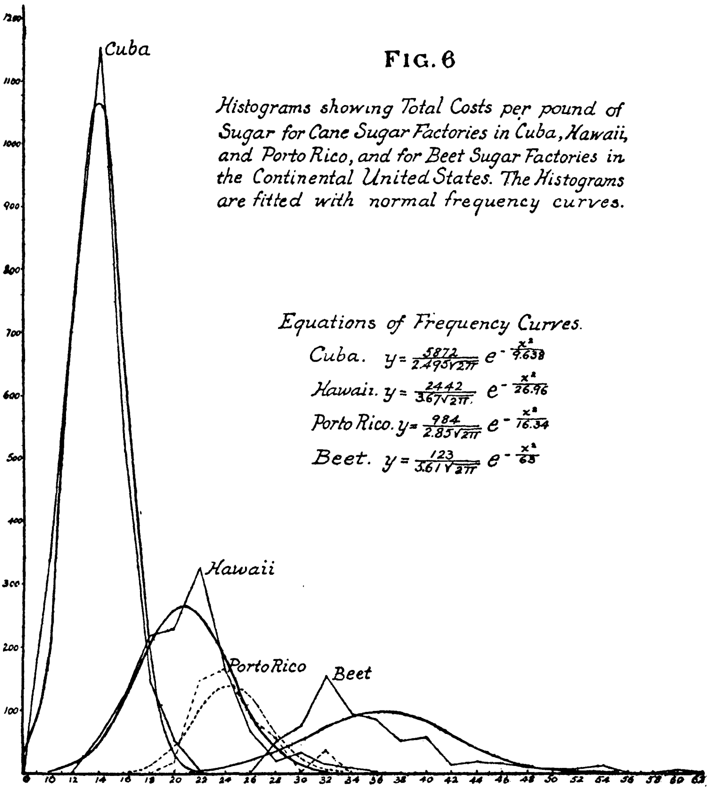

FIG. 6

Histograms showing Total Costs per pound of Sugar for Cane Sugar Factories in Cuba, Hawaii, and Porto Rico, and for Beet Sugar Factories in the Continental United States. The Histograms are fitted with normal frequency curves.

Equations of Frequency Curves.

Cuba. $y = \frac{5872}{2.495\sqrt{2\pi}} e^{-\frac{x^2}{9.638}}$

Hawaii. $y = \frac{2442}{3.67\sqrt{2\pi}} e^{-\frac{x^2}{26.96}}$

Porto Rico. $y = \frac{984}{2.85\sqrt{2\pi}} e^{-\frac{x^2}{16.34}}$

Beet. $y = \frac{123}{3.61\sqrt{2\pi}} e^{-\frac{x^2}{65}}$

The poor fit in the case of beet may possibly be accounted for by the wide dispersion of the industry through states of very different soil and climate — California, Colorado, Utah, Michigan, Ohio, and some other states.

The method is also interesting in illustrating the quantity of economic rent. The great mass of the sugar from Cuba is produced at a less cost than that of even the most efficient producers in Hawaii. The cost in Hawaii is on the whole less than the cost in Porto Rico, which in turn is less than the beet. The price for the year in which the data were collected averaged about 3.7 cents per pound, New York quotations. This may be assumed to be the cost to the marginal producer. If, then, we multiply this cost by the sum of the ordinates used in plotting the curve and subtract the sum of the products of successive ordinates and abscissas the result will be the quantity of economic rent. Denoting the cost to the marginal producer by m the quantity of economic rent may be expressed by the formula, $r = m\Sigma y - \Sigma xy$. (The discrete values of x and y used in plotting the curve must also be used in the formula.) In the present instance, however, there are some complications. The diagram was constructed on the basis of costs F.O.B. at the factory, excluding depreciation. When applying the formula to determine economic rent depreciation should be included. Moreover, the histogram for Cuba should be moved bodily to the right a distance which is the measure of one cent to allow for the tariff on Cuban sugars, and the histogram for beet should be moved to the left by about half that amount to allow for the difference between raw and refined sugar. (See footnote, p. 109.) Some additional shifting to the left and right to allow for freight differentials would also be necessary if the result is to approximate accuracy. Such shiftings would considerably lessen the range of rent-yielding costs. If the tariff were removed it is probable that producers now occupying marginal land would be squeezed out and the marginal cost lowered by nearly [1] the amount of the Cuban tariff. This would be shown by the disappearance of the right-hand portions of the beet, Porto Rican, and Hawaiian histograms, thus again lessening the range of rent-yielding costs.

In regard to costs under large and small scale production, a mere glance at Figure 2 shows that in Hawaii the large scale producers are also the low cost producers with respect both to plantation and factory costs, and in Hawaii where the plantations are to a large extent owned and operated by the factories this conclusion derived from inspection of the diagram is warranted. If the forty-five factories are arranged in accordance with their output of sugar and are then divided into three groups of fifteen factories each, it will be found that both the cane cost and the factory cost per pound of sugar produced vary inversely as the scale of production. The larger the scale of production, the smaller the cost, as is shown by the following table:

	Of total output, produce	At, cents per pound, cane cost	At, cents per pound, factory cost
Fifteen largest factories......	2/3	1.81	.31
Fifteen medium "	1/4	2.07	.38
Fifteen smallest "	1/12	2.15	.50

We are led to the conclusion that in Hawaii, at least, the economies of large-scale production apply to the plantation as well as the factory.

A table constructed from the data of the beet sugar industry would lead to a similar inference, but in this case the same conclusion would not be warranted. A large factory will consume a large quantity of beets and the beet cost may be low, but since the beets are usually purchased from a number of independent farmers working under contract, no inference can be drawn as to the scale of production. Our data do warrant us in concluding that the economies of large-scale production apply to the factory processes but not to the agricultural processes. Indeed, so far as we have data at all from the few factories that have attempted to grow their own beets the reverse appears to be the case. The cost of beets to such factories is higher than the cost when purchased from farmers.

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[1] "Nearly," because it is doubtful whether the full demand could be met at the present Cuban margin plus Cuban marketing costs.

To sum up: 1. The sugar industry illustrates admirably the theories of varying costs and economic rent. Competing concerns continue to produce for a common market at widely varying costs of production even as regards factory costs. 2. For the purposes of the rent theory the industry must be taken as a whole and classed as extractive through all its stages to the production of raw sugar in the case of the cane, and refined sugar in the case of the beet. 3. As regards the respective economies of large and small scale production, however, it is possible to discriminate between the factory and agricultural processes. The former shows unmistakably the economies of large-scale production in every region from which data were obtained, and in both branches of the industry. On the agricultural side, however, the beet sugar industry appears to verify the usual economic teachings in regard to the economics of small-scale production in extractive industries; while the cane sugar industry, in Hawaii at least, appear to offer opportunities for the highly capitalized methods of large-scale production on the plantation as well as in the factory.

Finally, it is hoped that this analysis may prove suggestive of methods that may be applied to data derived from other industries, and thus be of assistance in contributing to the much needed work of testing and verifying the conclusions of economic theory.

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